How are grades assigned?

Write out a paragraph explaining how your letter grade for the course will be determined.

Monty Hall Problem Simulation

Stay in the same groups of 2.
1. Simulate the game by playing 15 rounds. One player will be the host and will secretly pick a door. The other player will be the contestant, who will make a guess. The host will then cross off a door that doesn't have the prize. The player should stick with the original guess. Record the number of times the player won the prize.
2. Simulate the game for 15 more rounds where the player switches their guess each time. Record the number of times the player won the prize.
3. Decide whether the player should switch or not (or if it matters at all). Write a brief explanation of your conclusion.

Down and then Up

Suppose your employer tells you that, due to a downturn in sales, your pay will be cut by 10% this month. If sales pick up next month, however, you will then receive a 10% raise. Discuss whether this scenario would result in your eventual salary being higher, lower, or the same as your original salary.

Up and then Down

Suppose your employer tells you that you've earned a 10% raise this month due to strong sales. If sales drop next month, however, your pay will then be cut by 10%. Discuss whether this scenario would result in your eventual salary being higher, lower, or the same as your original salary.

Changes in Pricing

The cost of an unlocked iPhone 4s at the end of 2011 was $649. At the end of 2012, the same iPhone 4s could be bought for $549. Find the percent change in the cost of the iPhone 4s over that time period.

Shifting References

The average American spent $8,508 on health care in 2011. The cost of health care is projected to rise about 5.8% per year for the years 2012–2022. Calculate the projected amount the average American will spend on health care in 2014.
Hint: Note that the cost of health care in 2011, 2012, and 2013 all serve as reference amounts in this problem.

Computing Compound Interest

Find how much Phillip would have to pay back if he didn't pay until after the following number of weeks using each type of interest.

	Compound Interest (10%)	Simple Interest (10%)
After 1 week	$110	$110
After 2 weeks	$121	$120
After 3 weeks		
After 4 weeks		
After 5 weeks		

The Power of Compound Interest

When Benjamin Franklin died in 1790, his will left £1000 (British currency known as pounds) each to the cities of Boston and Philadelphia. Each city was to establish an account that would generate interest for 200 years, at which time the cities could withdraw the money to use for public works projects. If the Boston account compounded monthly at 4% and the Philadelphia account compounded monthly at 3.5%, how much more (in pounds) would Boston have at the end of the 200 years than Philadelphia? Write down a guess before calculating an exact result.

$$A = P \times \left(1 + \frac{r}{n}\right)^{nt}$$

Computing APY

A bank offers a CD (a type of investment account) that pays 2.27% interest compounded daily. The bank also lists this account has having an annual percentage yield of 2.30%.

Compute the compound interest earned on a one-year $100 investment with the rate 2.27%, compounded daily, using the formula $A = P \times \left(1 + \frac{r}{n}\right)^{nt}$.

Compute the simple interest earned on a one-year $100 investment with the annual rate 2.30% using the formula $I = P \times r \times t$.

Hint: Remember that A and I represent different things.

Probability Trees

Draw a probability tree that fits the following situation:
- First, flip a coin.
- If the coin comes up heads, draw a ball from an urn containing a white ball and a black ball.
- If the coin comes up tails, roll a standard 6-sided die.

The Product Rule and Addition Rule

Coins A and B are biased in the following manner:
- Coin A: $P(\text{H}) = \frac{2}{3}$, $P(\text{T}) = \frac{1}{3}$
- Coin B: $P(\text{H}) = \frac{1}{4}$, $P(\text{T}) = \frac{3}{4}$

Do the following:
- Draw the probability tree for flipping coin A followed by coin B, including the probabilities at each step.
- Determine the probability of each branch.
- Determine the probability of flipping one head and one tail.
- Determine the probability of flipping the same side twice.

Write down 6 sets of complementary events and make up possible probabilities for the event and the complement. Use fractions for 2 of them, decimals for 2 of them, and percents for 2 of them.

1.

2.

3.

4.

5.

6.

Balls and Urns - Part 1

Suppose you have an urn that contains 3 red balls and 7 black balls. Using your intuition, record your answers to the following questions.

- Are you more likely to draw two red balls if you draw with replacement or if you draw without replacement?
- Are you more likely to draw two black balls if you draw with replacement or if you draw without replacement?
- Are you more likely to draw one red ball and one black ball if you draw with replacement or if you draw without replacement?

Balls and Urns - Part 2

Suppose you have an urn that contains 3 red balls and 7 black balls.

1. Create a probability tree for drawing two balls with replacement and a tree for drawing two balls without replacement.
2. Determine the probability of drawing two red balls in each situation. Was your guess correct?
3. Determine the probability of drawing two black balls in each situation. Was your guess correct?
4. Determine the probability of drawing one red ball and one black ball in each situation. Was your guess correct?
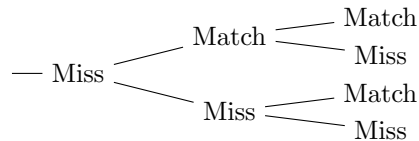
Sharing Your Birthday

1. Create a tree that shows all of the possibilities for picking three random people and determine which branches lead to at least one person sharing your birthday.
2. Use the property of complements and the multiplication rule to compute the probability that at least one person out of three will share your birthday.
3. Look for a pattern that you can use to compute the probability that at least one preson out of four will share your birthday.
4. How many people would you need to pick to have a 50% chance of at least one of them sharing your birthday?

The Birthday Paradox

1. Fill in the probabilities for the probability tree below. Note that "Miss" and "Match" mean that it misses *all* previously drawn birthdays or matches *some* previously drawn birthday.
2. Determine the probability of at least two people sharing a birthday out of three people.
3. Based on the change, take a guess as to the number of people it would take to have a 50% chance that two people would share a birthday.
- The answer to #3 is surprisingly small, which is why this problem is known as the birthday paradox. You will do this calculation for homework. The key branch is the Miss-Miss-Miss branch!

```
                                          ┌─ Match
                            Match ────────┤
             ┌─────────────┘              └─ Miss
 ── Miss ────┤
             └─────────────┐              ┌─ Match
                            Miss ─────────┤
                                          └─ Miss
```

Coincidences

1. Determine the probability of flipping heads 10 times in a row in 10 flips.
2. Suppose every NSC student flipped a coin 10 times in a row. How many of them would you expect to get all heads? (There are approximately 3300 NSC students.)

Conditional Probabilities 1

For each of the situations below, write out the entire sample space, remove portions based on the condition, then compute the probability.

1. When rolling two 6-sided dice, determine the probability of rolling a 5 if the total is 9.
2. When rolling two 6-sided dice, determine the probability of rolling a 1 or a 6 if the total is at least 7.
3. When rolling a 4-sided die and a 6-sided die together, determine the probability of rolling a 5 given that one of the dice is a 3.

Conditional Probabilities 2

For the following problem, assume that you have a biased coin and $P(\text{H}) = \frac{1}{3}$.

1. Draw the probability tree for two coin tosses and compute the probability of each outcome.
2. Determine the probability of flipping at least one head.
3. Determine the probability of flipping one head and one tail.
4. Determine the probability of flipping one tail given that at least one head was flipped. In other words, determine the probability of having $\{H, T\}$ if you know you have $\{H, ?\}$.
• Note: This is $P(X|Y)$ where $X = $ "Flip one tail″ and $Y = $ "Flip at least one head."

False Positive Paradox

Using the probability tree below, what is the probability that you have the disease if you test positive?
- Determine the probability of receiving a positive diagnosis.
- Determine the probability that you are sick and that you get a positive diagnosis.
- Determine the probability of being sick given that you received a positive diagnosis.

$$P(X|Y) = \frac{P(X \text{ when } Y \text{ also happens})}{P(Y)}$$

Roulette Calculations

A roulette wheel consists of 18 red numbers, 18 black numbers, and 2 green numbers. Each number is equiprobable.

1. Betting on red pays 1:1. Determine the expected value of betting \$1 on red.
2. Betting on green pays 17:1. Determine the expected value of betting \$5 on green.
3. Betting on any specific number pays 35:1. Determine the expected value of betting \$25 on a specific number.

Multi-Step Games

A gambling game is constructed in the following manner. One ball is chosen at random from an urn that contains one red ball, one white ball, and one blue ball. If it's the red ball, the player loses \$20. If it's the white ball, the player flips a coin; heads wins \$10 and tails loses \$10. If it's the blue ball, the player rolls a 4-sided die and wins \$5 times the number of the die (so rolling a 2 wins \$10).

1. Draw the probability tree for this game and compute the probabilities for each outcome.
2. Determine the value of each outcome.
3. Determine the expected value of this game.

The House Edge

Craps is played with two six-sided dice. It is possible to make wagers on the outcome of a single roll (called proposition bets).
- Betting on any 7 pays 4:1. Determine the house edge on this wager.
- Betting on craps (any 2, 3, or 12) pays 7:1. Determine the house edge on this wager.
- What would the house edge be if the payout odds for craps were 7.5:1 instead of 7:1? (As they are in some places.)

Statistical Sampling 1

1. Gather data on the age of all the people in the classroom.
2. Determine the mean, median, and mode of the data.
3. Explain why this is probably not a representative sample of the ages of people living in the state of Nevada.

Statistical Sampling 2

Everyone will contribute to the data by flipping a coin 10 times. (Catch the coin in the air!) You will report the number of heads that are flipped.

1. Create a frequency table for the coin-flipping data collected by the class.
2. Determine the mean, median, and mode of the data.

Computing Standard Deviations

Consider the following sample data set:

$$\{22, 18, 19, 23, 23, 15\}$$

1. Determine N and μ for this data set.
2. Create a chart with the columns i, x_i, μ, $x_i - \mu$, and $(x_i - \mu)^2$.
3. Compute σ.
4. Construct a frequency table for the data.
5. Plot the distribution. Is the distribution normal or skewed?

Percentile Calculations

Example: Consider the following list of data, listed from smallest to largest for convenience:

$$\{2, 6, 8, 10, 14, 16, 19, 19, 20, 100\}$$

1. How many data points is the number 10 greater than?
2. 10 is in what percentile?
3. What percentile is 19 in? (Hint: 19 is not greater than 19.)
4. What numbers are in the 100th precentile?

z	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
-2	.023	.018	.014	.012	.008	.006	.005	.003	.003	.002
-1	.159	.136	.115	.097	.081	.067	.055	.045	.036	.029
-0	.500	.460	.420	.372	.344	.308	.274	.242	.212	.184
0	.500	.540	.580	.618	.656	.692	.726	.758	.788	.816
1	.841	.864	.885	.903	.919	.933	.945	.955	.964	.971
2	.977	.982	.986	.988	.992	.994	.995	.997	.997	.998

Percent of Data Between Two Values

1. Determine the percent of data that falls between $z = -1$ and $z = 1$.
2. Determine the percent of data that falls between $z = -2$ and $z = 2$.
3. Determine the percent of data that falls between $z = 0$ and $z = 1$.

Three-Coin Sequences

1. Analyze both lists of 75 tosses by breaking them each into 25 three-coin sequences and creating a frequency table for each possibility. Keep the two lists separate.
2. If every outcome is equally likely, what is the probability that a random list of 25 three-coin sequences will not have any HHH or TTT combinations? (Hint: Think about a hit-miss probability tree.)
3. Does one of the two distributions appear to be more even than the other? If so, which one looks more even?
4. Compare your results with others. Is there a general pattern that is emerging?

Swap Analysis

1. Analyze both lists of 75 tosses by counting the number of swaps.
2. For this number of coin tosses, the number of swaps is normally distributed with $\mu = 37$ and $\sigma \approx 4.3$. Determine the z-score for the number of swaps in both lists.
3. Does either list fall outside of 2 standard deviations from the mean on this measure?
4. Only 5% of the data should fall outside of 2 standard deviations from the mean. Determine the percent of data in the class that falls outside of 2 standard deviations from the mean. If this is significantly above 5%, then this is an indication that fraud exists in the data.
• Note: Being a suspect is not the same as being guilty. In a classroom of 20 students, we expect to have some student's legitimate data fall into the list of suspects. This is just another warning to not draw conclusions too quickly.

Runs Analysis

1. Analyze both lists of 75 tosses by counting the number of runs of each length and determining the longest run.

2. Below are the runs results of 10,000 simulated lists of 75 coin tosses each with the average number of runs of a given length falling into each category. How closely does your distribution match the simulation?

Length	1	2	3	4	5	6	7	8	9
Runs	18.7	9.4	4.8	2.3	1.1	0.6	0.3	0.1	0.1

3. Below is the percent of lists that had different length longest runs. Determine the percentile for the length of the longest run for both of your lists.

Length	≤ 3	4	5	6	7	8
Percent	0.2	6.8	22.6	26.8	19.6	11.6
Length	9	10	11	12	≥ 13	
Percent	6.4	3.2	1.3	0.8	0.7	

Monthly Car Payments

A car has a price of $12,000$. It may be purchased on installment plans of several lengths. The longer the plan, the more total interest the borrower pays. For each of the loan terms shown below, calculate the simple interest rate the borrower will be charged.

Auto Loan

Loan term	Total Interest	Interest Rate
48 *months*	$3,500$	
60 *months*	$5,000$	
72 *months*	$6,500$	

Amoritization Tables

Fill out the remainder of the first 5 entries in this amortization table showing a home loan of $165,000$ over 360 months (30 years) at 4.5%.

Month	Payment	Principal paid	Interest paid	Balance
Month 1	$836.03	$217.28	$618.75	$164,782.72
Month 2	$836.03			
Month 3	$836.03			
Month 4	$836.03			
Month 5	$836.03			

Hint: The interest paid in month 2 is the amount found when the annual rate of 4.5% is applied to $164,782.72 for one month.

A credit card example

Suppose a card's billing cycle began Aug. 8 and carried a balance of $57.54. The card user purchases $63.44 of gasoline on Aug. 12, $32.30 for entertainment on Aug. 19, and $66 for jeans on Sep. 1. The card user also makes a $100 partial payment to the card company on Aug. 25.

Find the card's balance for each day of the BC. Then find the ADB.

Aug. 8 $57.54	Aug. 9	Aug. 10	Aug. 11	Aug. 12	Aug. 13	Aug. 14
Aug. 15	Aug. 16	Aug. 17	Aug. 18	Aug. 19	Aug. 20	Aug. 21
Aug. 22	Aug. 23	Aug. 24	Aug. 25	Aug. 26	Aug. 27	Aug. 28
Aug. 29	Aug. 30	Aug. 31	Sep. 1	Sep. 2	Sep. 3	Sep. 4
Sep. 5	Sep. 6	Sep. 7				

Computing a Finance Charge

Using the formula, compute the finance charge for the ADB and BC you just found with an APR of 27.99%.

$$\text{FC} = \text{ADB} \times \frac{\text{APR}}{365} \times \text{BC}$$

What will the balance be on the credit card on Sep. 8?

Affordability Guidelines

Use one or more of the affordability guidelines to suggest maximum mortgage amounts for the following individuals:

Hunter has approximately $25,000 in student loan debt, makes $45,000/year, and is single with no dependents.

Amy & Ben have 2 young children, one of whom requires frequent medical care. Ben makes $42,000/year while Amy makes $37,000/year. The couple pay $600/month in childcare and have two modest car payments.

Stephanie is a single-mom of one school-aged child who makes $50,000/year at her regular job and $1,000/month in consulting fees. She spends $150/month on student-loan payments.

Joanna is a recent college graduate with $20,000 in outstanding student loans, $3,000 credit card debt, and is interviewing for full-time jobs while supporting herself on tips from her job as a waitress.

The Total Cost of a Mortgage

Cynthia & Simon are interested in purchasing a home in a city where the property tax rate is 1.25%. The home they are considering is appraised at $200,000 and would have an annual insurance bill of $660. Additionally, because they cannot afford a large down payment, PMI will cost them $200 per month.

Calculate the total monthly cost of the mortgage for Cynthia & Simon if the mortgage payment itself is $965.05.

Buying Points

Lola is interested in buying points for her mortgage. Her 30-year mortgage amount is $190,000 with a 6.00% interest rate. Her bank will let her buy up to two points worth 0.25% points off her rate each, at a cost of 1% of the mortgage per point.

Use a mortgage payment calculator like that found at `http://www.bankrate.com/calculators/mortgages/mortgage-calculator.aspx` to help you compute how many months it will take Lola to save as much in interest as she would originally spend on the points.

Interest vs. Inflation

If Stefano invested $1,000$ in a CD in 2008 at 1.8%, how much would the account have after 5 years?
Recall: $A = P\left(1 + \frac{r}{n}\right)^{nt}$
The average rates of inflation for the 5 years of Stefano's investment are shown below.[a]

Inflation (%)				
2008	2009	2010	2011	2012
3.8	−0.4	3.2	2.1	1.5

1. What is the dollar amount of Stefano's investment at the end of 5 years?
2. Using the inflation rates, determine how much money in 2012 is equivalent to $1,000$ in 2008.

⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

[a]http://www.usinflationcalculator.com/inflation/historical-inflation-rates/

Inflation vs. Retirement

David and Victoria are each 5 years from retirement with a combined income of $100,000$. If inflation is projected to continue at 2.5% annually, how much will they need to withdraw from savings during their first year of retirement to match their current buying power?

Inflation vs. Savings

Carissa is ready to retire and has accumulated savings of $500,000 to do so. She currently spends $50,000 a year.
1. If inflation occurs at 3% per year, how much will Carissa have to spend each year, for the next 10 years, to maintain her buying power?
2. If Carissa withdraws from savings the amount she needs each year on Jan. 1, and her remaining savings earns 2% simple interest each year, what will be her savings balance after
   (a) 3 years?
   (b) 5 years?
   (c) 10 years?
3. Give an estimate of how much Carissa would need in her savings at retirement to maintain her buying power for 20 years, taking into consideration the effects of inflation. Give reasons for your estimate.

Is it a Function?

For each item below determine whether one quantity is a function of the other quantity. If yes, then also do the following:
  (a) Determine which variable is independent and which is dependent.
  (b) Sketch a reasonable graph to illustrate the relationship.
  (c) Write one or two sentences justifying the shape and behavior of your sketch.

1. The temperature in the LAS parking lot and the time of day—

2. The cost of pizza and the diameter of the pizza—

3. Your course grade and your shoe size—

4. Education level of a person and the amount of that person's salary—

5. Credit card interest paid and the balance due on the account—

6. The day of the year and the number of hours of daylight—

7. A male's optimal weight and a male's height—

Napolean's Keyrings

Napolean runs a home business selling boondoggle keyrings. His business license costs $10/month. He makes a profit of $0.80 for each keyring he sells. Define a function whose independent variable is the number of keyrings he sells in a given month and whose dependent variable is the profit he makes that month. Provide
- a graphic of the function,
- a table of function values, and
- a symbolic form of the function.

Water Filling a Container

Go to `https://student.desmos.com/` and enter the code your instructor gives you.
Be sure to enter both names. Follow the instructions of the activity. There is no write-up for this activity.

Profits From Boondoggle

Napolean wants to start a business selling boondoggle keyrings. Let x be the price he charges for each keychain.

Demand With the price of each keychain at x dollars, Napoleon expects to sell $500 - 100x$ keychains.

Costs The rent for the facilities will be $200 while the material costs $0.20 per keychain.

1. Find the cost function $C(x)$.
2. Find the revenue function $R(x)$.
3. Find the profit function $P(x)$.
4. At what price should Napolean sell the keychains to maximize his profit? (Try plotting $P(x)$ on desmos.com.)

Bounds for Dating Ages

It has been suggested that a person of age x should only date a person whose age is at least $f(x) = \frac{1}{2}x + 7$.

1. According to this formula, what is the minimum age of a person that a 24-year old should date? And for a 36-year old?
2. Find the inverse function of $f(x)$ and call it $g(x)$. (Recall that wolframalpha.com can help you find an inverse function.) What is the intepretation of the output of $g(x)$?
3. According to this formula what is the maximum age of a person that a 24-year old should date? And for a 36-year old?
4. In desmos.com plot $f(x)$, $g(x)$ and $f(x) < y < g(x)$. What does the shaded region represent?
5. Plot a few points at desmos.com in the form (x, y) to represent couples you know. Does the model fit?

Coupons and Discounts

You clip a \$5 off coupon from the newspaper for a pair of shoes. At the store you find that all the shoes are 10% off.

1. Write a function $f(x)$ that shows the effect of the coupon.
2. Write another function $g(x)$ that shows the effect of the store discount.
3. Make a new function $h(x) = f(g(x))$ and determine whether this function applies the coupon before or after the discount.
4. Make a new function $k(x) = g(f(x))$ and determine whether this function applies the coupon before or after the discount.
5. Which pricing model do you think the store is most likely to choose? (Hint: compare $h(50)$ and $k(50)$.)

In the pre-lecture assignment you learned some of the key characteristics of several functions. Take a minute to sketch the graph of each of the following functions.

$y = x$ $y = \sqrt{x}$ $y = x^2$ $y = \frac{1}{x}$ $y = x^3$ $y = |x|$
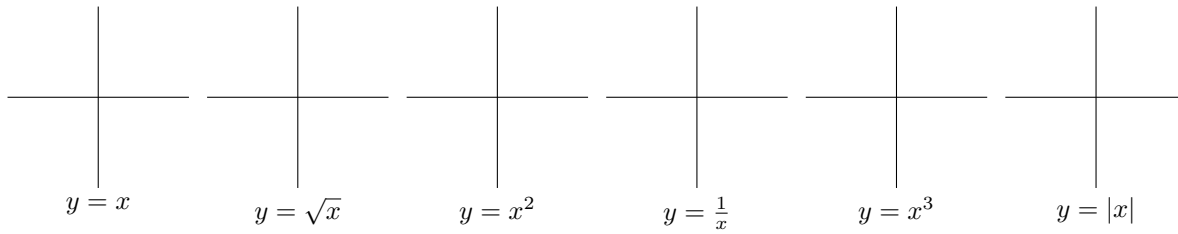
Parent Functions in Models

Discuss each question below with a partner. Identify a function and determine what the x and y-variables might represent.

1. Which of the parent functions would be the best function to model an infant's growth from birth?

2. Which of the parent functions could model the distance that an object has fallen over time?

3. Which of the parent functions would give us the volume of a cube with side length x?

4. Which of the parent functions might model the amount of money you earn at your job over time?

Transforming a Circle

Open up `desmos.com` and enter the code `(x-h)^2+(y-k)^2=r^2`. Then create a slider for each of the variables. With the help of the sliders describe the effect on the circle for each scenario below.

1. When h increases _____.

2. When k increases _____.

3. When r increases _____.

Finding a Formula of a Circle

Find a formula for the circle in the image. (It is centered at the point $(3, 4)$ and it goes through the origin.)
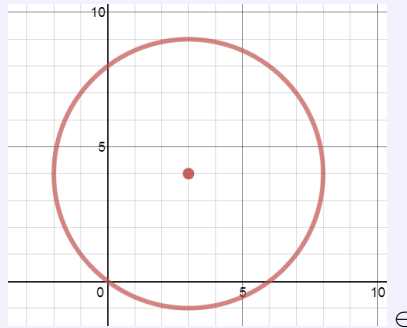
Finding a Formula for Distance Fallen

An object is thrown off a building. The function $f(t)$ gives the distance (in ft) that the object has fallen after t seconds. We observe the following values.

t	0	0.5	1	1.5	2	2.5	3
$f(t)$	0	4	16	36	64	100	144

1. Find a formula for $f(t)$.
2. How far has the object fallen after 10 seconds?
3. How far does the object fall between seconds 6 and 7?

Measuring the Tide

The tide level is measured every 5 hours. The table below gives the level of the tide in feet above the low tide level.

time (in h)	0	5	10	15	20	25	30	35
tide level (in m)	0	1.48	3.73	3.41	1.00	0.07	2.00	3.93

1. Find a function of the form $f(x) = a\cos(bx) + k$ that outputs the tide level after x hours.[a]
2. Estimate the level of the tide after 27 hours.
3. Does your model seem realistic? Explain.

⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
[a]This is not the only possible form of the function, but it will work in this case. In general a wave function might have the form $a\sin(b(x-h)) + k$ or $a\cos(b(x-h)) + k$. We will learn the specific details about shifting and scaling parameters in another section.

A Population Model

A settlement starts out with a population of 1000. Each year the population increases by 10%. Let $P(t)$ be the function that gives the population in the settlement after t years.

1. Find the missing values in the table below.

t	0	1	2	3	4	5	6	7
$P(t)$	1000							

2. Find a formula for $P(t)$ using the values from the table.
3. Find a formula for $P(t)$ by reasoning it out directly.
4. What will the population be after 100 years?
5. Is this a realistic model?

Logarithm Practice

Evaluate each logarithm. Try to do it without a calculator.

1. $\log_6(36)$

2. $\log_7\left(\frac{1}{7}\right)$

3. $\log_{10}(1000)$
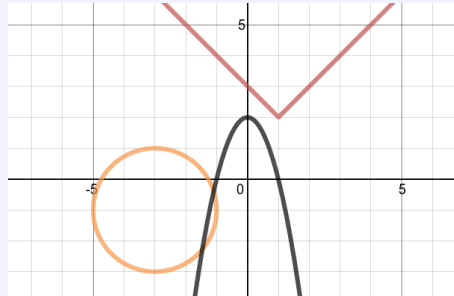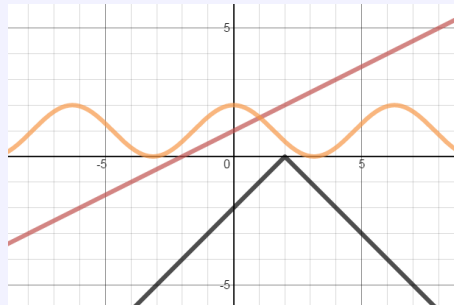
4. $\ln(1)$

5. $\log_2(4)$

6. $\log_4(2)$

Mystery Curves

Below we see the graphs of three curves. Find the equation of each curve.

Mystery Curves II

Below we see the graphs of three more curves. Find the equation of each curve.

A Change of Heart

Go to `https://www.desmos.com/calculator/h4p6yr39pi` and create 5 transformations of the heart-shaped graph. Try to do it without peeking at the answer. Record the equations below.

Purple:

Blue:

Orange:

Green:

Black:

Braking Distance

The table below gives the distance that a car will travel after applying the brakes at a given speed.

Speed (in mi/h)	Distance to stop (in ft)
10	5
20	19
30	43
40	76.5
50	120
60	172
70	234

1. Find a function that outputs stopping distance when you input speed.
2. Estimate the stopping distance for a car that is traveling $43 \, \text{mi/h}$.

Tide Levels

The tide level is measured every 5 hours. The table below gives the level of the tide in feet above the low tide level.

Time (in h)	Tide level (in ft)
0	0
5	1.48
10	3.73
15	3.41
20	1.00
25	0.07
30	2.00
35	3.93

1. Find a function that outputs the tide level after t hours.
2. Estimate the level of the tide after 27 hours.

Brick Wall

You plan to make a diagonal brick wall as shown, but you don't know how many bricks to buy. You figure that the brick wall will have 100 rows. (The top row is row 1; the next row is row 2; etc.)
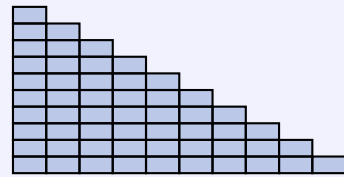

Let $f(x)$ be the number of bricks used through x. Thus $f(1) = 1$, $f(2) = 3$, $f(3) = 6$, and so forth.
1. Find $f(4)$, $f(5)$, and $f(6)$.
2. Find a formula for $f(x)$.
3. How many bricks will be needed to complete 100 rows?
4. How many bricks would be needed to complete 1000 rows?

Bessy's Dream Pen

Bessy the cow wants to build her dream pen out of $600\,\text{ft}$ of fencing. Her design calls for a rectangular pen that she will subdivide into two subpens as pictured. What are the values of x and y that will provide Bessy with the maximum enclosed area?
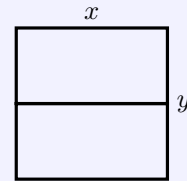
1. Write an equation that gives the total number of feet of fence in terms of x, y and $600\,\text{ft}$
2. Solve that equation for y.
3. Write an expression that gives the area of the pen, A, in terms of x and y.
4. Replace y with an appropriate function of x.
5. Find the value of x that maximizes the area function $A(x)$.

A Rectangle Under a Curve

A rectangle in Quadrant I has one corner at the origin and the opposite corner on the curve $y = \sqrt{9 - x}$. In this problem we want to find the length and width of the rectangle that has the maximum area.
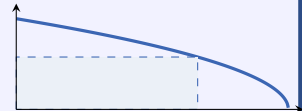
1. Plot the curve and a sample rectangle.
2. Make a guess for the value x that gives a maximum area for the rectangle.
3. Write out a formula for the area of the rectangle.
4. Find the dimensions of the rectangle of maximum area under the curve.

The Minimum Perimeter of a Triangle

Suppose we have a triangle with a base of $12\,\text{cm}$ and a height of $4\,\text{cm}$ as pictured. There are many such triangles possible, one of which has smaller perimeter than all others. Our goal in this problem is to find the length, x, that gives the triangle with smallest perimeter.
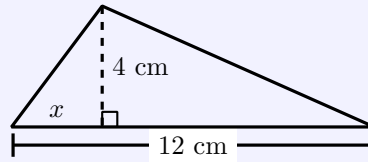
1. Use the Pythagorean Theorem to find the length of the missing sides of the triangle.
2. Create a function $P(x)$ that gives the perimeter of the the big triangle.
3. What is the perimeter when $x = 0$?
4. Find the value of x that minimizes the perimeter function $P(x)$.
5. What is the minimum possible perimeter?